PATENT
Claims

1.   (original) A method of monitoring a kiln used for drying wood, comprising:

obtaining a known good set of samples of preliminary moisture content data; and

estimating three parameters of a Lognormal distribution which approximate the known good data set, the three parameters comprising a threshold parameter, a shape parameter and a scale parameter.

2.   (original) The method of claim 1, further comprising:

developing control limits and a center line configured for at least one control chart monitoring at least one of the three estimated parameters;

obtaining at least one sample of new moisture content data from a batch of kiln-dried wood;

transforming the new data to form transformed data which can be compared to the control limits and center line; and

presenting a visual representation of the relation of the transformed data to the control limits and center line configured for the at least one control chart.

3.   (original) The method of claim 2, further comprising determining if the kiln is approaching an out-of-control state based at least in part on the relation of the transformed data to the control limits and center line; and

wherein presenting a visual representation of the relation comprises, at least in part, displaying an indicator of the status of the kiln.

4.   (original) The method of claim 3, wherein determining if the kiln is approaching an out-of-control state is performed without human interaction.

5.   (original) The method of claim 2, wherein presenting a visual representation of the relation comprises visually displaying a control chart with the transformed data displayed on the chart.

6.   (original) The method of claim 2, wherein:

- each sample contains at least two measurements of moisture content data; and

each sample contains identical numbers of moisture content measurements.

7.   (original) The method of claim 6, wherein estimating the scale and shape parameters comprises:

subtracting the estimated threshold parameter from each preliminary moisture content

PATENT

measurement;

normalizing each adjusted measurement by transforming each measurement logarithmically;

determining, for each sample in the preliminary data, a mean transformed value from the transformed values in the sample;

estimating the scale parameter by determining the mean of the mean transformed values for each preliminary sample; and

estimating the shape parameter by:

determining the standard deviation for the transformed values for each preliminary sample; and

adjusting the standard deviation to account for bias.

8.   (currently amended) The method of claim 6, wherein transforming the new data comprises:

subtracting the estimated threshold parameter from each moisture content measurement; and

————normalizing each adjusted measurement by transforming each measurement logarithmically[[;]].

9.   (original) The method of claim 8, wherein the control limits and center line are configured for a control chart which monitors the scale parameter;

wherein transforming the new data further comprises determining a transformed mean value for each sample by determining the mean of all of the normalized measurements in the sample; and

wherein developing the control limits and center line configured for at least one control chart comprises:

setting the center line to be the estimated scale parameter; and

setting the control limits by determining limits based on the standard deviation of the mean values for the transformed samples around the estimated scale parameter.

10.   (original) The method of claim 9, wherein limits are 3-sigma limits.

11.   (original) The method of claim 9, wherein the control limits and center line are configured for a control chart has a logarithmic scale.

PATENT

12.   (original) The method of claim 9, wherein the control limits and center line are configured for a control chart which has the same measurement scale as the new moisture content data;

        wherein transforming the new data further comprises:

                recovering the transformed mean value for each sample back into its original scale by exponentiation;

                adding back the estimated threshold parameter to each recovered mean value for each sample; and

        wherein developing the control limits and center line further comprises:

                transforming the control limits and the center line back into the original scale by exponentiation; and

                adding back the estimated threshold parameter to the transformed control limits and center line.

13.   (original) The method of claim 8, wherein the control limits and center line are configured for a control chart which monitors the shape parameter;

        wherein transforming the new data further comprises, for each sample, determining the standard deviation of all of the normalized measurements in the sample; and

        wherein developing the control limits and center line comprises:

                setting center line by finding the mean of all of the standard deviations of each transformed preliminary sample; and

                setting control limits by determining probability limits for the standard deviations for the preliminary data samples.

14.   (currently amended) The method of claim 13, wherein <u>developing the control limits and center line</u> ~~setting the center line~~ further comprises adjusting the mean of standard deviations to account for bias.

15.   (original) The method of claim 13, wherein the control limits and center line are configured for a control chart which has a logarithmic scale.

16.   (original) The method of claim 13, wherein the control limits and center line are configured for a control chart which has the same measurement scale as the new moisture content data;

        wherein transforming the new data further comprises:

PATENT

recovering the transformed standard deviation for each sample back into the original scale by exponentiation;

adding back the estimated threshold parameter to each recovered standard deviation for each sample; and

wherein developing the control limits and center line further comprises:

transforming the control limits and the center line back into the original scale by exponentiation; and

adding back the estimated threshold parameter to the transformed control limits and center line.

17.   (original) The method of claim 13, wherein determining probability limits comprises determining probability limits based on chi-square distribution.

18.   (original) The method of claim 1, wherein the threshold parameter is estimated through the use of a local maximum likelihood estimator.

19.   (original) The method of claim 1, wherein the threshold parameter is estimated through the use of modified moment estimators.

20.   (original) The method of claim 1, wherein the known good set of samples of preliminary moisture content data comprises data gathered when the kiln is known to be in an in-control state.

21.   (original) The method of claim 2, wherein the known good set of samples of data is taken under conditions similar to the conditions under which the at least one new data sample is obtained.

22.   (original) The method of claim 21, wherein the similar conditions include at least one of the following: kiln temperature, drying time, wood type, kiln type.

23.   (original) The method of claim 2, wherein the known good data set comprises multiple data points and obtaining at least one sample of new data further comprises gathering at least two data points independently.

24.   (original) The method of claim 2, wherein the good data set comprises multiple data points and obtaining at least one sample of new data further comprises gathering at least two data points randomly.

25.   (original) The method of claim 2, wherein the new data was gathered at a separate time from the known good data set.

PATENT

26.   (original) The method of claim 2, wherein the new data comprises at least two data points gathered randomly.

27.   (original) The method of claim 2, wherein the new data comprises at least two data points gathered independently.

28.   (original) A computer-readable medium containing instructions that, when followed, perform the following steps:

obtaining a known good set of samples of preliminary moisture content data from a batch of kiln-dried wood;

estimating, based at least in part on the preliminary moisture content data, parameters for a Lognormal distribution which approximates the preliminary data;

obtaining new moisture content data from a batch of kiln-dried wood;

using the estimated Lognormal distribution parameters, creating control limits and a center line configured for control charts measuring shape and scale of the distribution of new data;

transforming the new data so that it can be represented on the control charts; and

presenting a visual representation of the relation of the transformed data to the control limits and center line configured for a control chart.

29.   (original) The computer-readable medium of claim 28, further comprising determining if the kiln is approaching an out-of-control state by comparing the transformed data to the control limits and center line.

30.   (original) The computer-readable medium of claim 28, wherein the visual representation of the relation of the transformed data to the control limits and center line is a control chart.

31.   (original) The computer-readable medium of claim 28, wherein the known good set of preliminary moisture content data is obtained when the kiln is known to be in-control.

32.   (original) The computer-readable medium of claim 28, wherein the control limits and center line are configured for a control chart which has a logarithmic scale.

33.   (original) The computer-readable medium of claim 28, wherein the control limits and center line are configured for a control chart which has the same scale as the moisture content data.